

PRESS RELEASE

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Laboratory for Machine Tools and
Production Engineering (WZL) of
RWTH Aachen University

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oraKel for SMEs

App-based Quality Prediction and Root Cause Failure Analysis with Artificial Neural Networks for Small and Medium Enterprises

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Modern machinery control systems provide many data about the running production process, but only the specialized analysis of the data allows a deeper insight. In this way, useful information and optimization potential can be extracted and the testing effort can be reduced. The product quality can be predicted with mathematical models from the process data, such as pressures, temperatures or flows. Creating these models by hand is not only time-consuming, but also requires extensive expert knowledge of the manufacturing process. New developments in the field of data science now make it possible to determine these models automatically from the process data. Machine learning methods such as neural networks are used for this purpose. Neural networks learn from the database and can then be used to predict product quality and to analyze the causes of defects. However, small and medium-sized enterprises (SME) often lack the necessary knowledge and resources to successfully implement machine-learning methods. They are therefore denied great potential for process improvement and error correction.

To fill this gap in the future, the two-year oraKel project was launched at the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University in February 2020 in cooperation with companies from various industries. Within the scope of the project, the Chair of Production Metrology and Quality Management, lead by Prof. Robert H. Schmitt, will focus on the development of algorithms based on neural networks for automated quality prediction and root cause failure analysis in production. The aim is to reduce testing efforts and to build up process knowledge.

App Prototype and Guidelines for Small and Medium Enterprises

In order to make the automated prediction of product quality accessible to small and medium-sized companies and to raise the underlying potential, the main goal of the oraKel project is the implementation of an app that enables the efficient use of quality prediction without requiring in-depth expert knowledge of neural networks. Furthermore, the knowledge is extracted from the neural networks and prepared for failure analysis and process optimization. As a prerequisite for the app, a data basis of process data and test results is required. To create this basis, process data is recorded and stored in a database together with the results of the physical quality test. In addition, companies are provided with guidelines for data recording.

Within the scope of the project, a prototype of the app will be implemented and tested with selected industry partners. In order to ensure the best possible ergonomics, the app interfaces of the individual work steps, such as data recording, quality prediction and error correction, will be designed in cooperation with industrial partners and end users. Following the project, participating companies can use the app freely.

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The advantages of using quality predictions for industrial companies are considerable: First of all, the effort for quality testing is reduced to random samples to validate the prediction. The need for physical testing also decreases, which means that less measuring equipment and testing machines need to be purchased and maintained. By automatically extracting knowledge about critical manufacturing parameters from the neural networks, the app also identifies the causes of errors more quickly and reduces start-up times for similar manufacturing processes with less personnel effort.

In order to develop the app over the next two years, the industrial partners from oraKel's project-accompanying committee will provide suitable data sets and production-related use cases. The WZL staff will then use case studies to select the necessary data preparation methods and suitable types of neural networks. During

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the kick-off meeting in Aachen in February 2020, suitable processes and available data sets were determined with the companies, requirements for data acquisition were discussed, and basic principles for neural networks were developed.

The oraKel project is funded by the AiF and the FQS Forschungsgemeinschaft Qualität e. V. In the research of the algorithms as well as the development of the app, the Chair of Production Metrology and Quality Management is supported by a project-accompanying committee of industrial partners who are engaged in consulting, provision of CAQ software and production. This includes: IconPro GmbH, GFE – Gesellschaft für Fertigungstechnik und Entwicklung Schmalkalden e.V., Siemens AG, CemeCon AG, Q-DAS GmbH, Bayer AG, iqs Software GmbH, Sanofi Aventis Deutschland GmbH, Risse & Co. GmbH, Transfact GmbH, CERO-BEAR GmbH, Lauscher Präzisionstechnik GmbH, gbo datacomp GmbH, Qsee Ltd. and CemeCon GmbH.

Further information can be found at orakel.wzl.rwth-aachen.de.

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Laboratory for Machine Tools and Production Engineering (WZL)

The Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University enhances the innovative strength and competitiveness of the industry with trend-setting basic research, applied research and the associated consulting and implementation projects in the field of production technology. In the research fields of manufacturing technology, machine tools, production engineering, gear technology as well as production metrology and quality management, practical solutions for rationalizing production are developed with industrial partners from a broad range of branches.